

July 1, 1952

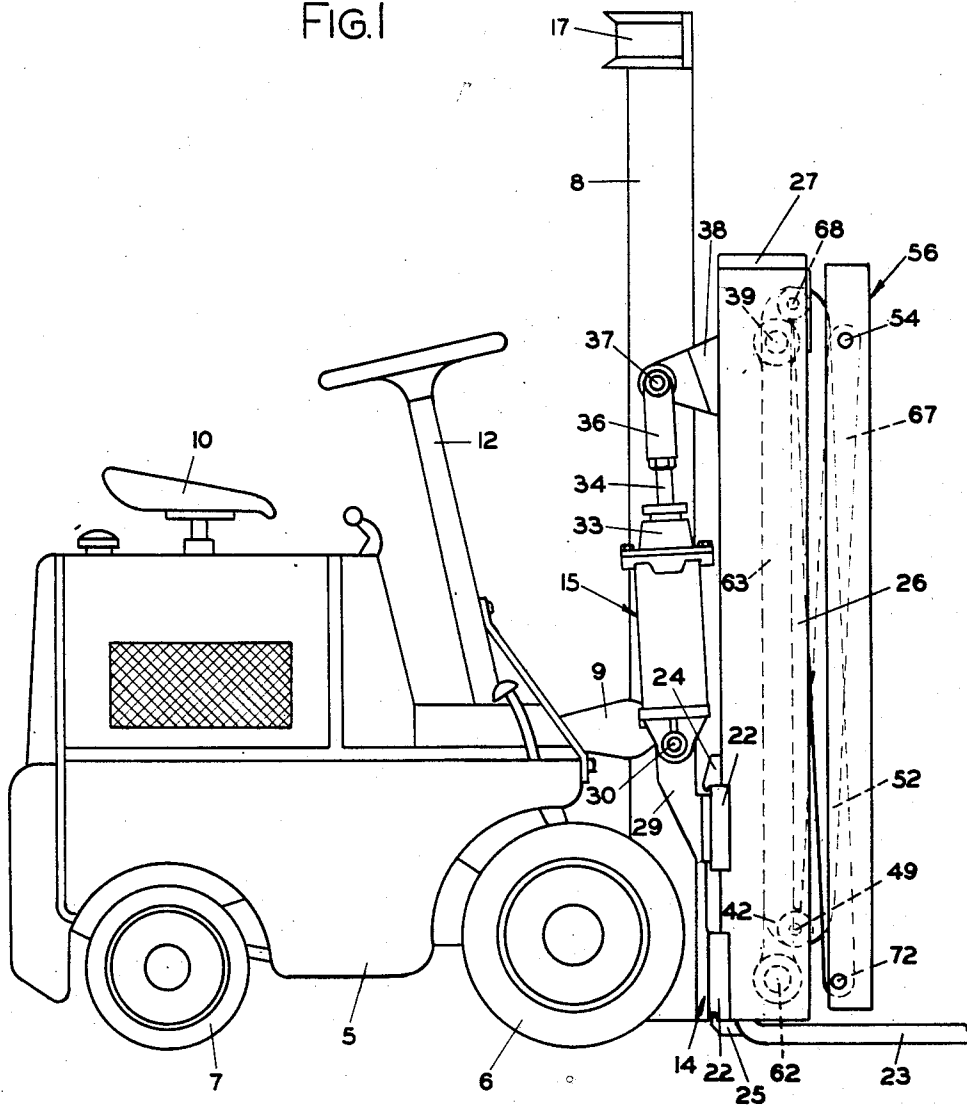
E. J. DUNHAM ET AL
INDUSTRIAL TRUCK

2,601,931

Filed March 10, 1949

5 Sheets-Sheet 1

FIG. 1



INVENTORS:
ELMER J. DUNHAM
ALFRED WAYNE GUNNING
BY *Ernest Jackson,*
Boothby & Seamer
ATTYS.

July 1, 1952

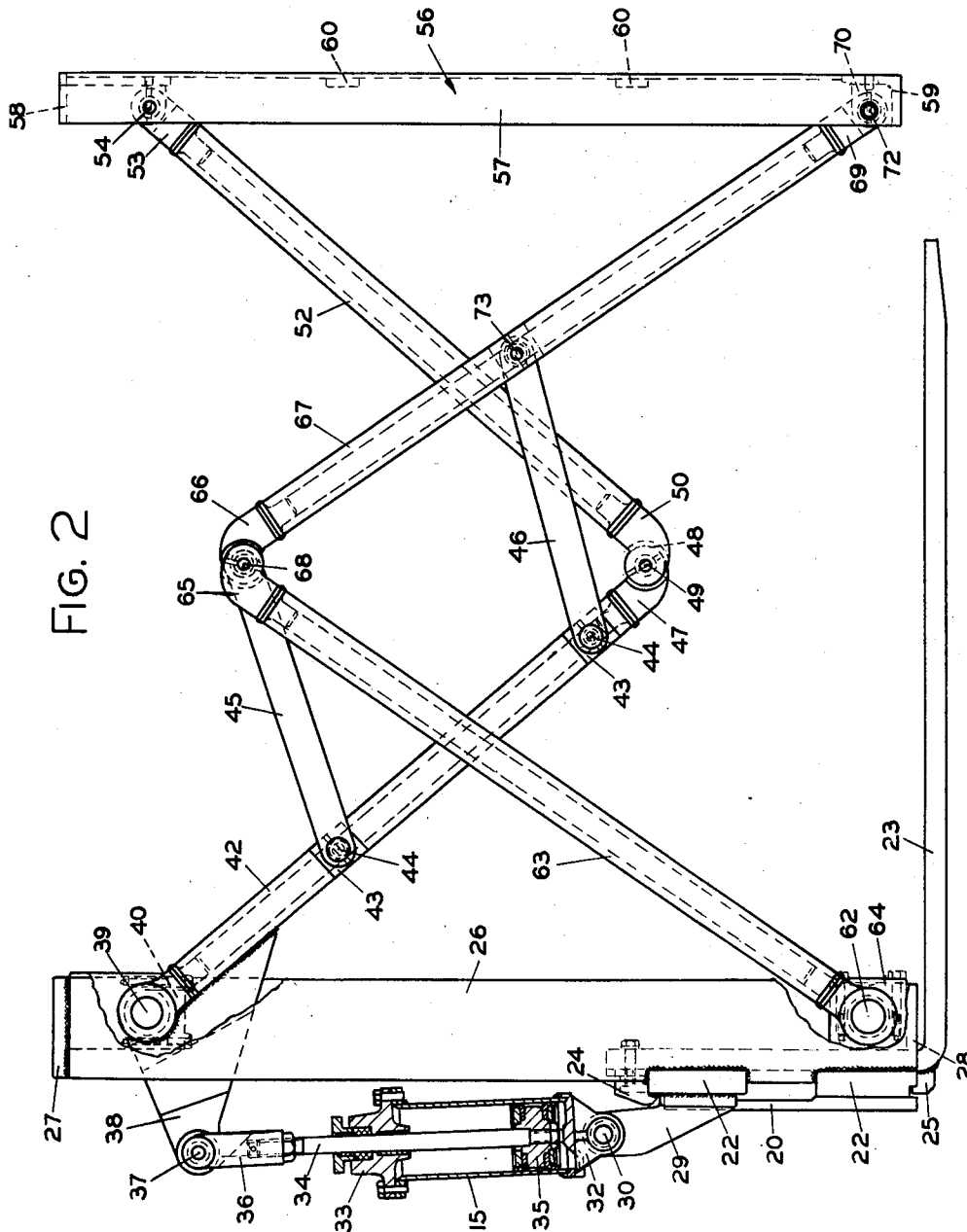
E. J. DUNHAM ET AL

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INDUSTRIAL TRUCK

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5 Sheets-Sheet 2



INVENTORS:
ELMER J. DUNHAM
ALFRED WAYNE GUNNING
BY *Brown, Jackson,
Cretcher & Levine*
ATTYS.

July 1, 1952

E. J. DUNHAM ET AL

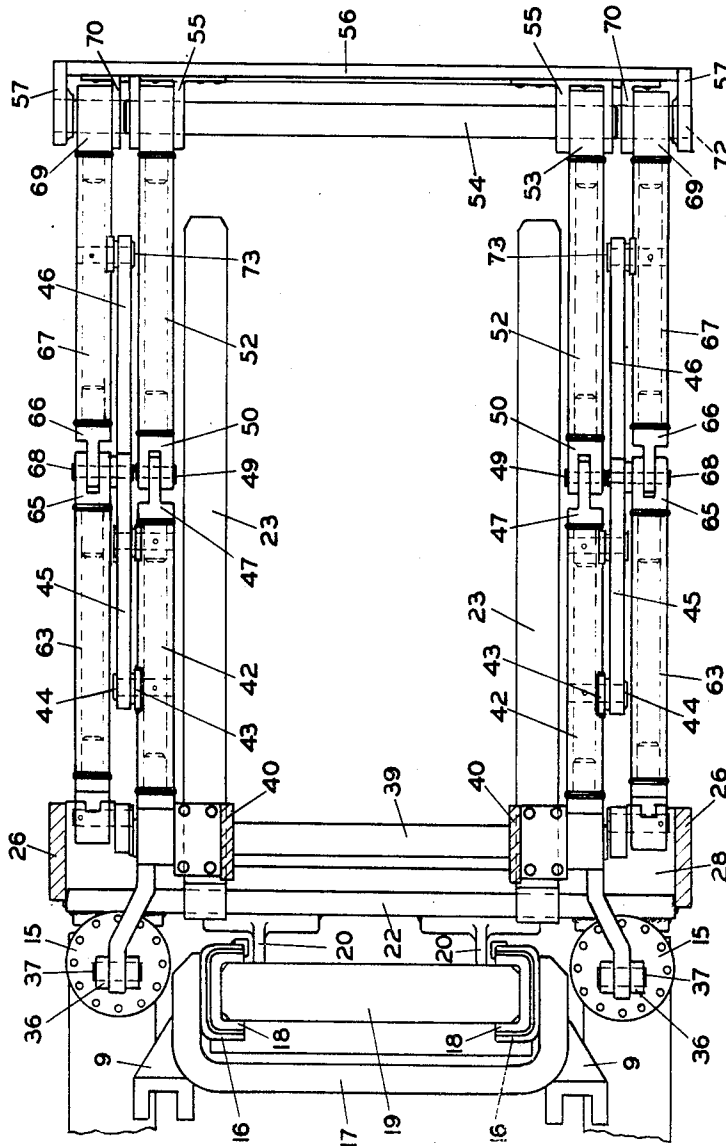
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INDUSTRIAL TRUCK

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5 Sheets-Sheet 3

FIG. 3



INVENTORS:
ELMER J. DUNHAM
ALFRED WAYNE GUNNING
BY *Brown, Jackson,
Bottcher & Seiner*
ATT'YS.

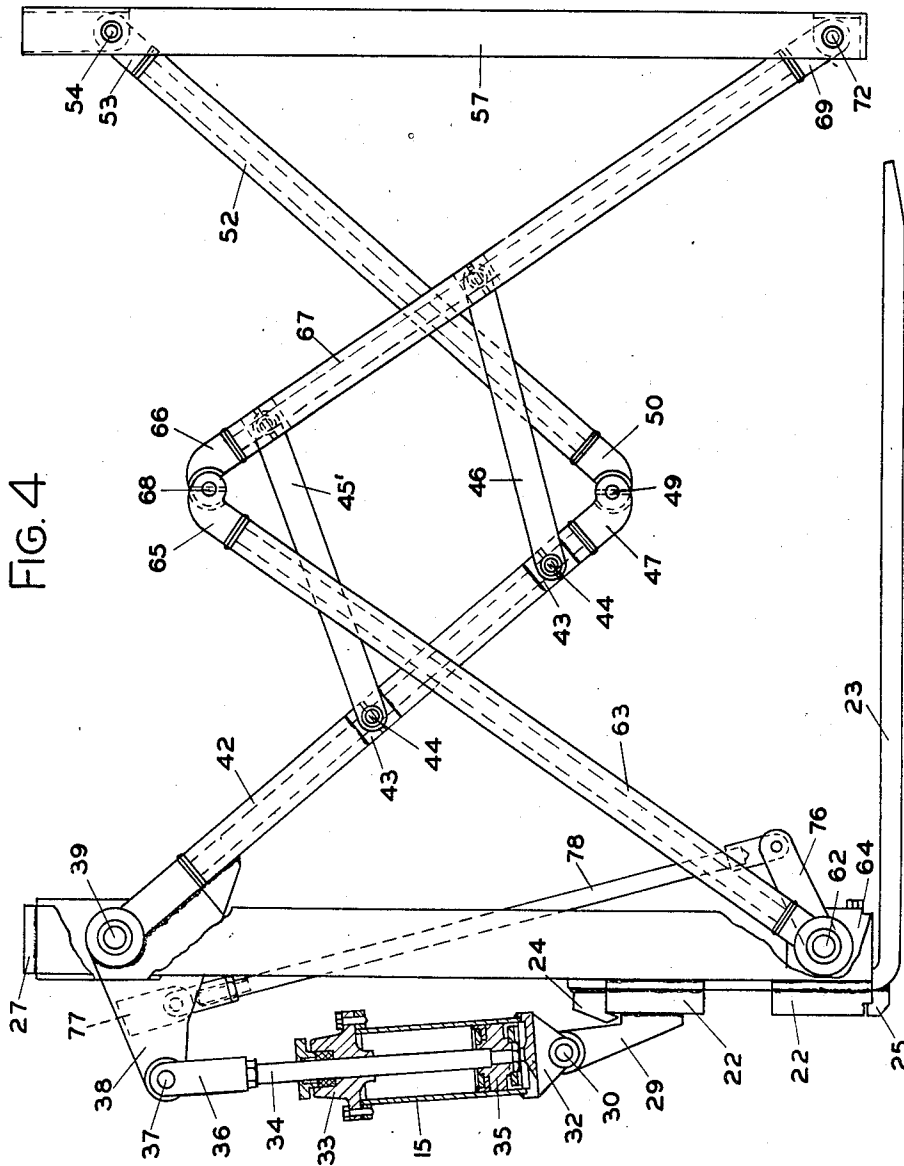
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E. J. DUNHAM ET AL
INDUSTRIAL TRUCK

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5 Sheets-Sheet 4



INVENTORS:
ELMER J. DUNHAM
ALFRED WAYNE GUNNING
BY *Brown, Jackson,
O'Rourke & Quinn*
ATTY'S.

July 1, 1952

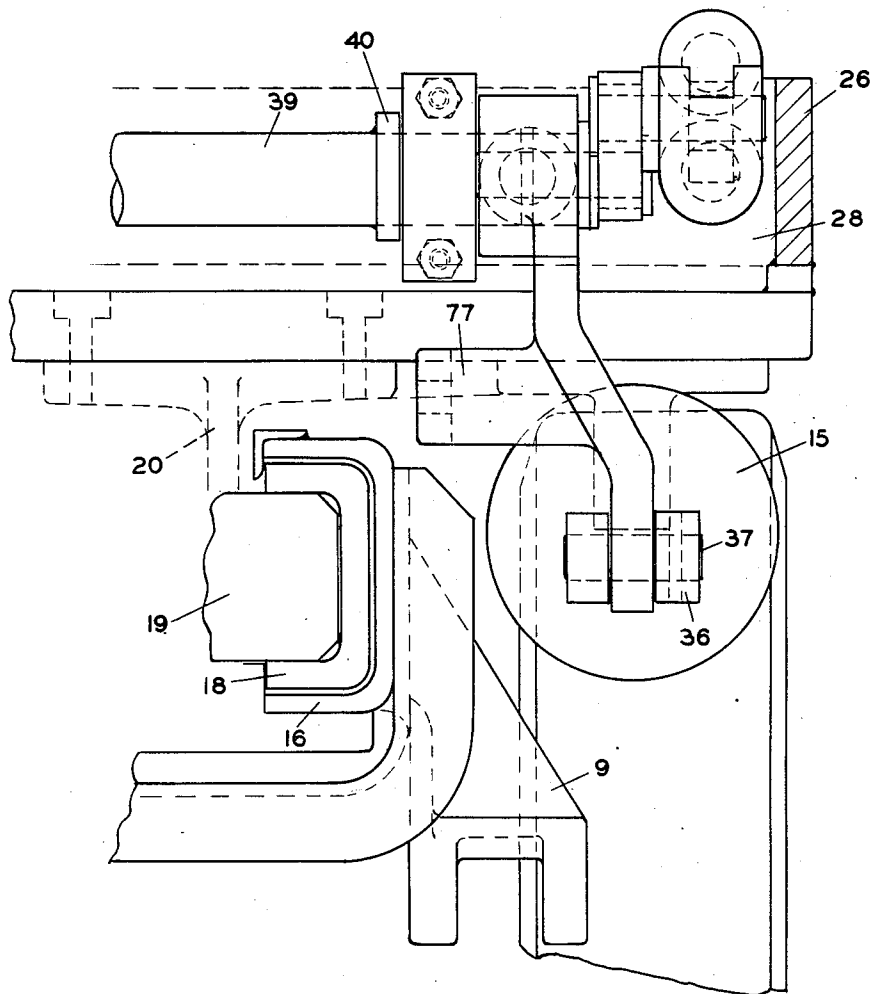
E. J. DUNHAM ET AL
INDUSTRIAL TRUCK

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5 Sheets-Sheet 5

FIG. 5



INVENTORS:
ELMER J. DUNHAM
ALFRED WAYNE GUNNING
BY *Brown, Jackson,
Bretcher & Kinner*
ATTYS.

UNITED STATES PATENT OFFICE

2,601,931

INDUSTRIAL TRUCK

Elmer J. Dunham and Alfred Wayne Gunning,
Battle Creek, Mich., assignors to Clark Equip-
ment Company, Buchanan, Mich., a corpora-
tion of Michigan

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6 Claims. (Cl. 214—82)

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This invention relates to industrial trucks and more particularly is directed to an industrial truck of the fork lift type having a mechanism associated with the load elevating carriage for discharging the load from the carriage, this being commonly known as a pusher mechanism.

There have been numerous attempts heretofore to provide a pusher mechanism for pushing off loads carried on the forks or load supporting apron of the truck to discharge the same into a box car or the like, such mechanism being either designed for pushing the load off a pallet carried by the forks or pushing the load and the pallet off together.

The present invention concerns itself more directly with the pusher mechanism per se and it may be used with a lift fork or apron construction on the load supporting carriage.

The present construction is adapted to be mounted upon a more or less conventional type of load supporting carriage, and is adapted for hydraulic actuation both in the pushing off movement and in the retracting movement. It primarily consists of a load engaging rack which is disposed vertically with respect to the load supporting fingers or apron and which is actuated through a linkage system pivotally mounted on a supporting member carried by the load supporting carriage under the influence of hydraulic piston means connected to one of the links.

The linkage means of the present invention is capable of retraction to a folded position nesting within the supporting member, with the rack disposed closely adjacent the heel of the forks or load supporting apron, and is capable of extension to a position beyond the forward extremities of the forks.

One of the primary objects of the present invention is to provide a mechanism of this type which can be extended to its fully extended position with a relatively small stroke of a hydraulically actuated piston and which can be equally well retracted into a folded position adjacent to the rear end of the projecting load supporting means.

Another object of the present invention is to provide a construction of this type in which the load engaging rack is held in such position that it moves in substantially a straight horizontal line with the linkage mechanism being sufficiently sturdy to support it against the gravitational effect, even when in fully extended position, and to provide a sturdy non-cocking action to prevent any binding of the pivotal connections or the like.

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Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawings, will disclose to those skilled in the art the particular construction and operation of a preferred form of the present invention.

In the drawings:

Figure 1 is a side elevational view of an industrial truck equipped with one form of pusher mechanism constructed in accordance with our invention in retracted position;

Figure 2 is a corresponding elevational view, partly in section, of the rack mechanism of Figure 1 in extended position;

Figure 3 is a plan view of the rack mechanism of Figure 1 in extended position;

Figure 4 is a side elevational view of another embodiment of our invention; and

Figure 5 is a plan view of the pusher mechanism of Figure 4.

Referring now in detail to Figures 1 through 3 of the drawings, there is provided an industrial truck, indicated generally at 5, having the forward driving wheels 6 and the rear steering wheels 7. The truck, adjacent its forward end, is provided with the vertical mast or upright assembly 8 pivotally mounted for fore and aft tilting movement adjacent its lower end, and having a suitable bracket connection 9 to a hydraulically controlled piston for controlling the tilting movement.

The driver seat is indicated at 10 and is disposed adjacent the steering column 12 which controls the movement of the rear steering wheels 7. The truck is provided with a power plant, such as an internal combustion engine having pump means associated therewith for developing fluid under pressure which is used not only for raising and lowering the load supporting carriage 14 guided for vertical movement within the mast 8, but also for actuating the tilting mechanism 9 and the rack actuating mechanism, indicated generally at 15.

Considering now the pusher mechanism in more detail, a conventional load supporting carriage 14 is provided and it preferably comprises a body member 19 mounted for vertical movement in the mast 8. The mast 8 is preferably formed of U-shaped channel members 16 rigidly connected at their upper ends by the cross member 17 and telescoping channel members 18 are mounted for sliding movement therein, and within which is mounted the body member 19 of the load supporting carriage. The body member 19

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has forwardly projecting arms 20 upon which are mounted vertically spaced face plates 22 which support forwardly projecting load engaging forks 23. These forks 23, at their upper ends, are provided with suitable bracket portions 24 hooking over the upper edge of the upper face plate 22, and each have a corresponding tongue member 25 engaging behind the lower edge of the lower face plate 22.

In place of the forks 23 a solid supporting apron may be employed, or widened forks may be used for engaging the load to be carried by the truck. The particular type of load engaging means is not pertinent to the present invention and, therefore, the forks 23 are illustrated to show a conventional type of load engaging mechanism employed with trucks of this type.

Also mounted upon the face plates 22 and secured thereto as by welding or the like, are supporting members 26 which are disposed adjacent opposite ends of the face plates 22 and extend vertically thereabove, being tied together at their upper ends by the transverse plate member 27, and at their lower ends by a transverse plate member 28.

Extending rearwardly from the upper face plates 22 adjacent each side thereof, but within the confines of the supporting members 26, are brackets 29 which may be welded or otherwise secured to the rear face of the upper face plate 22 and which, at their upper ends, form a pivotal support as indicated at 30, for the base 32 of a hydraulic cylinder assembly, indicated generally at 15, and which has the head end thereof 33 provided with a suitable gland assembly for receiving the extending end 34 of a piston rod connected to the piston 35 disposed within the cylinder.

The piston rod 34, at its upper end, is connected through a suitable clevis member 36 to a pivotal shaft 37, carried by the rearwardly extending end 38 of a crank member extending between the vertically extending supporting plates 26, and the crank member 38 is mounted on a shaft member 39 which is rotatably journaled in brackets 40 secured to and depending from the transverse members 27.

Also fixed to the shaft member 39 and rigidly secured to the crank member 38 is the extending arm 42, there being one such arm provided at each end of the shaft inter-connected with the crank 38 controlled through the piston and cylinder assembly 15.

The arms 42 are preferably tubular in form, and intermediate their ends, are provided with bosses 43 welded or otherwise secured thereon, which bosses have extending pivot studs 44 for mounting one end of a pair of links 45 and 46 thereon. The ends of the arms 42 opposite their pivotal connections to the shaft 39, are each provided with a fitting 47, having a stud portion extending into the tubular end thereof and terminating in a tongue portion 48 which is pivotally connected by means of the transverse pin 49 to the bifurcated end of a similar member 50, welded into the end of a second tubular arm member 52 to provide a rigid connection therebetween.

The opposite ends of the arms 52 are each provided with a fitting 53 having an apertured end receiving the transverse shaft 54 carried by brackets 55 secured to the rear face of the rack member indicated generally at 56. This rack member comprises a vertically extending plate or grid which has substantially the same vertical extent as the supporting plates 26 and which, at

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its ends, is reinforced by means of side plates 57 and adjacent its upper and lower edges, has transversely extending plates 58 and the angle 59. The rack also is provided with intermediate reinforcing members 60 as shown in Figure 2.

A shaft 62 is rotatably supported at its opposite ends by suitable brackets 64 mounted upon the transverse plate 28 at the lower ends of the supporting plates 26. Tubular arms 63 are connected to the shaft 62 and are provided with fittings 65 similar to the fittings 47, except that they are bifurcated to receive the tongue ends of the fittings 66 carried by the tubular arms 67. Transverse pins 68 extend through the fittings 65 and 66 to provide a pivotal connection therebetween and these pins also provide for pivotally mounting of the opposite end of the links 45.

The tubular members 67 are similar to the arms 63 and at their opposite ends are each provided with a fitting 69 which is pivotally mounted between the lower end of a side plate 57 and a bracket 70 upon a transverse shaft 72 carried by the rack 56. The opposite end of each link 46 is pivotally connected to an arm 67 intermediate its ends by means of the stud 73. Thus it will be seen that the upper end of the rack and the supporting member are tied together through the pivotal connections of arms 42 and 52, while the lower end of the rack member is tied to the supporting member through the pivotal connections between arms 63 and 67. This provides what might be termed a pantograph type motion, with the links 45 and 46 interconnecting the tubular members 42 and 52 to the tubular members 63 and 67 and further providing a limiting control for preventing extension of the rack 56 beyond a predetermined point.

When the piston 35 in the cylinder 15 is moved upwardly from the position shown in Figure 2, it produces a corresponding pull in a clockwise direction upon the arms 42. This, in turn, moves the pivotal connection 49 between arms 42 and 52 downwardly retracting the upper end of the rack 56. Simultaneously, of course, due to the interconnection of the links 45 and 46 between arms 42 and arms 63 and 67, the arm 63 is rotated in a counter-clockwise direction together with shaft 62 drawing the pivotal connection 68 toward the upper portion of the support 26 and consequently, retracting the lower end of the rack 56.

Due to the interconnection of the links 45 and 46, this produces conjoint movement of the rack toward retracted position and into a position such as shown in Figure 1 with the arms 42 and 63 being nested within the side plates 26 of the support.

Similarly, when the piston is moved downwardly in the cylinder 15, it produces a corresponding rotation of crank 38 to rock arms 42 in a counter-clockwise direction, thereby raising the pivotal point 49 and extending the rack 56, the arms 63 being simultaneously rotated in a clockwise direction to apply substantially equal thrust to the top and bottom of the rack for maintaining it in a vertical plane while it is extending horizontally.

As will be apparent from Figure 1, the arms 42 and 63 are nested substantially within the confines of the support plate 26 when the rack is in retracted position, with the arms 52 and 67 being substantially nested within the confines of the side members 57 of the rack, thereby allowing the rack to approach closely the front edge of the support plates 26 and to be retracted into a re-

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tracted position adjacent the heels of the fork members 23. It will be noted that both of the pivotal connections 49 and 68 at this time are between the side members 26, thereby reducing, to a considerable extent, the spacial requirements of the arms when the rack is in retracted position.

Furthermore, due to the linkage arrangement, it will be seen that a similar support for the rack to prevent it from dropping as it is extended forwardly, is provided, thus providing a sturdy support of the rack during its horizontal travel from the retracted position to the extending position. The linkage arrangement also provides for producing a relatively larger extending movement, with a short movement of the piston assembly, thus providing for rapid extension and contraction by reason of the use of a short stroke of the piston within the cylinder 15.

The afordescribed embodiment of our invention, while satisfactory for most instances of use, is subject to the disadvantage that when the upper end of the rack 55 is engaged with a load to a greater extent than the lower portion of the rack, the linkage is such that the upper end of the rack will be caused to be tilted rearwardly. In the form of the invention shown in Figures 4 and 5, this disadvantage is overcome by the provisions of suitable bracing means indicated generally at 75 between the upper and lower shafts 39 and 62 extending between the side frame members 26 of the pusher supporting frame. The parts of the pusher mechanism of Figures 3 and 4 which are identical, or substantially so, with the above described parts of the pusher mechanism of the embodiment shown in Figures 1 through 3 bear the same reference numerals, in view of which a further description of such parts is not believed to be necessary.

The bracing means 75, as shown in Figures 4 and 5, comprises a first lever or crank arm 76 which is secured fast to the shaft 62 adjacent one end thereof inwardly of a side frame member 26 and substantially immediately below the crank arm 38 fixed to the tubular arm 42. The crank arm 38, as shown in this embodiment of our invention, is formed with a bracket member 77 at a portion thereon disposed rearwardly of the upper shaft 62. A rod 78 is provided at its opposite ends with suitable clevis members 79 and 80, with the latter having adjustment means for adjusting the effective length of the rod, to provide for pivotally connecting the opposite ends of the rod to the crank arm 76 and bracket member 77.

The folding linkage operates in the manner previously described with the additional function served by the bracing means 75 of preventing backward movement of the upper portion of the rack under the circumstances above related. It will be observed that the bracing means 75 serves to connect the upper and lower shafts 39 and 62 to which, in turn, are fixed the tubular arms 42 and 63, respectively, so that the latter are moved conjointly in a positive manner upon movement of the rack against a load and preventing collapsing of either of the two sets of arms 42 and 53 for the upper end of the rack 55, or of the arms 63 and 67 for the lower end of the rack.

It will also be observed that in the last referred to embodiment of our invention, that the position of the connecting link 45' has been slightly altered in that the link 45' is arranged directly between the arm 42 and arm 67. The one end

of the link 45', as before, has pivotal connection with the arm 42 and the other end is pivotally connected to arm 67 as by means of a boss 43 and stud 44, as previously described, rather than having such other end pivotally mounted as on the stud 68 providing for pivotally connecting the arms 42 and 67 together. This change is primarily an expedient in the construction of the device, and does not alter the operation of the pusher mechanism as already described.

We are aware that various changes may be made in certain details of the present constructions and therefore, do not intend to be limited except as defined by the scope and spirit of the appended claims.

We claim:

1. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the inner end thereof, said supporting frame comprising a pair of side frame members extending vertically adjacent opposite sides of said load supporting means, and a pair of shafts extending horizontally between said side frame members one adjacent each of the upper and lower ends thereof, a load engaging rack adapted to extend substantially vertically above said load supporting means, linkage means between said shafts and said rack comprising, first arm means mounted at one end on the shaft extending between the upper ends of said side frame members, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally connected together adjacent their other ends, a third arm means mounted at one end on the shaft extending between the lower ends of said side frame members, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, and link arms extending between said first and fourth arm means.

2. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the inner end thereof, said supporting frame comprising a pair of side frame members extending vertically adjacent opposite sides of said load engaging means, and a pair of shafts extending horizontally between said side frame members one adjacent each of the upper and lower ends thereof, a load engaging rack adapted to extend substantially vertically above said load supporting means, and linkage means between said shafts and said rack comprising, first arm means mounted at one end on the shaft extending between the upper ends of said side frame members, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally connected together adjacent their other ends, third arm means

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mounted at one end on the shaft extending between the lower ends of said side frame members, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, link means extending between said first and fourth arm means, crank arms connected to said pair of shafts, and rod means pivotally connected at the opposite ends thereof to said crank arms.

3. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the inner end thereof, said supporting frame comprising a pair of side frame members extending vertically adjacent opposite sides of said load engaging means, and a pair of shafts extending horizontally between said side frame members one adjacent each of the upper and lower ends thereof, a load engaging rack adapted to extend substantially vertically above said load supporting means, and linkage means between said shafts and said rack comprising, first arm means mounted at one end on the shaft extending between the upper ends of said side frame members, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally connected together adjacent their other ends, third arm means mounted at one end on a shaft extending between the lower ends of said side frame members, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, link means extending between said first and fourth arm means, a first crank means connected to the shaft between the upper ends of said side frame members and extending generally rearwardly of said supporting frame means, a second crank means connected to the shaft between the lower ends of said side frame members and extending generally forwardly of said supporting frame, and rod means pivotally connected at the opposite ends thereof to said crank means.

4. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the inner end thereof, said supporting frame comprising a pair of side frame members extending vertically adjacent opposite sides of said load supporting means, and a pair of shafts extending horizontally between said side frame members one adjacent each of the upper and lower ends thereof, a load engaging rack adapted to extend substantially vertically above said load engaging means, and linkage means between said shafts and said rack comprising, first arm means mounted at one end on the shaft extending between the upper ends of said side frame members, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally

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connected together adjacent their other ends, third arm means mounted at one end of a shaft extending between the lower ends of said side frame members, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, link means extending between said first and fourth arm means, a first crank means connected to the shaft between the upper ends of said side frame members and extending generally rearwardly of said supporting frame means, a second crank means connected to the shaft between the lower ends of said side frame members and extending generally forwardly of said supporting frame, rod means pivotally connected at the opposite ends thereof to said levers, and fluid pressure actuated means connected to said linkage means for moving said rack substantially horizontally forwardly and rearwardly above said load supporting means.

5. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the inner end thereof, a load engaging rack adapted to extend substantially vertically above said load supporting means, linkage means between said supporting frame and said rack comprising, first arm means mounted at one end to the upper end of said supporting frame, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally connected together adjacent their other ends, third arm means mounted at one end adjacent the lower end of said supporting frame, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, and link arms extending between said first and fourth arm means.

6. A pusher mechanism for an industrial truck having carriage means mounted thereon and including load engaging means extending forwardly of the truck for supporting a load to be carried by the truck comprising, a supporting frame adapted to be mounted on said carriage means to extend transversely of said load supporting means closely adjacent the upper end thereof, a load engaging rack adapted to extend substantially vertically above said load supporting means, linkage means between said supporting frame and said rack comprising, first arm means mounted at one end to the upper end of said supporting frame, second arm means pivotally mounted at one end adjacent the upper end of said rack, said first and second arm means extending downwardly toward each other and being pivotally connected together adjacent their other ends, third arm means mounted at one end adjacent the lower end of said supporting frame, fourth arm means pivotally mounted at one end adjacent the lower end of said rack, said third and fourth arm means extending upwardly toward each other and being pivotally connected together adjacent their other ends, link arms extending between said first and fourth arm means, first crank means connected to the upper end of said first arm means

and extending generally rearwardly of said supporting frame, second crank means connected to the lower end of said third arm means and extending generally forwardly of said supporting frame, rod means pivotally connected at the opposite ends thereof to said first and second crank means, and fluid pressure actuated means connected to said linkage means for moving said rack substantially horizontally forwardly and rearwardly above said load supporting means.

ELMER J. DUNHAM.

ALFRED WAYNE GUNNING.

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